Chapter 4: Future Transportation Needs

This chapter describes how Junction City's transportation system needs will change through the planning horizon year of 2035. The discussion begins with an analysis of how projected growth in housing and employment will affect transportation patterns and concludes with an evaluation of the transportation system's ability to serve these new demands. The findings from this chapter will inform the development of transportation system solutions to be included in the TSP.

FUTURE LAND USE

Land use is a key factor affecting the demands placed on Junction City's transportation system. The location, density, type, and mixture of land uses have a direct impact on traffic levels and travel patterns. Housing and employment estimates for Junction City were obtained from several sources including the Lane County coordinated population forecasts for the Junction City urban growth boundary (UGB),[1] the Comprehensive Plan Housing Element,[2] and Economic Opportunities Analysis.[3] Land use totals for the Junction City UGB are identified below.

TABLE 1: Junction City Land Use Totals (within the UGB)

Year	Households	Employment
2010	2,582	3,545
2035*	4,455	7,240
Growth (2035-2010)	1,862	3,695

*2035 UGB includes Comprehensive Plan expansion areas.

The land use totals identified in Table 1 were allocated within the UGB based on an inventory of existing uses, expected build-out of vacant or underdeveloped lands, and Comprehensive Plan zoning. To facilitate the process of distributing land use growth, groups of tax lots were combined into Transportation Analysis Zones (TAZs). Growth by TAZ in terms of households

[1] Population Forecasts for Lane County, its Cities, and Unincorporated Area 2008-2035, Portland State University Population Research Center, May 2009 as adopted by Lane County, Ordinance PA 1255 (June 17, 2009).

[2] Draft Housing Element, Junction City Comprehensive Plan, City of Junction City, June 2012

[3] Draft Commercial and Industrial Buildable Lands Inventory and Economic Opportunities Analysis, ECONorthwest & Winterbrook Planning, June 2009.

and employment are depicted in Figure 1 and Figure 2, respectively. Detailed land use data by TAZ was previously documented in Technical Memorandum #3 (See Appendix A).

Household growth by TAZ, projected through the year 2035, is shown in Figure 1. The majority of household growth is expected to occur on the west side of OR 99. Areas with the most expected household growth (where growth exceeds one hundred households per TAZ) are west of Oaklea Drive, southeast of Oaklea Drive/W 18th Avenue, east of Pitney Lane just south of High Pass Road/W 1st Avenue, and east of Prairie Road near Bailey Lane. The areas of growth reflect proposed Comprehensive Plan changes, which increased the amount of medium density residential land designations, and re-designated low density residential and professional-technical districts to higher density residential land.

Figure 2 shows expected employment growth by TAZ. Most employment growth is expected to occur in the southern portion of Junction City, along OR 99 south of OR 36. Much of this growth corresponds to the proposed Oregon State Hospital and the State Correctional Facility.

FUTURE TRAFFIC VOLUMES

Design hour (weekday p.m. peak hour) traffic volumes for the year 2035 were developed using a combination of the local housing and employment growth along with growth in regional through trips. The volumes were estimated using a travel forecasting tool developed specifically for Junction City that converts land uses into motor vehicle trips. These trips are routed through the roadway network taking into consideration speeds, intersection controls, and delay caused by congestion. This traffic forecasting methodology was reviewed and approved by representatives from Junction City, Lane County, and ODOT. The detailed methodology, assumptions, and development process of the travel forecasting tool is described in Technical Memorandum #3, with is included in Appendix B.

The 2035 design hour intersection traffic volumes are shown in Figure 3. Most of the growth in traffic volumes occurs along OR 99 and other key arterial routes such as High Pass Road, Oaklea Drive, and 18th Avenue. Pitney Lane, OR 36, and Prairie Road also experience moderate levels of traffic growth due the relationship between residential growth on the west side of the city and employment opportunities at the south end of the city and in Eugene. Planning for street extensions to serve areas of future development will be an important element of the TSP.

DKS Associates TRANSPORTATION SOLUTIONS | REAL URBAN GEOGRAPHICS

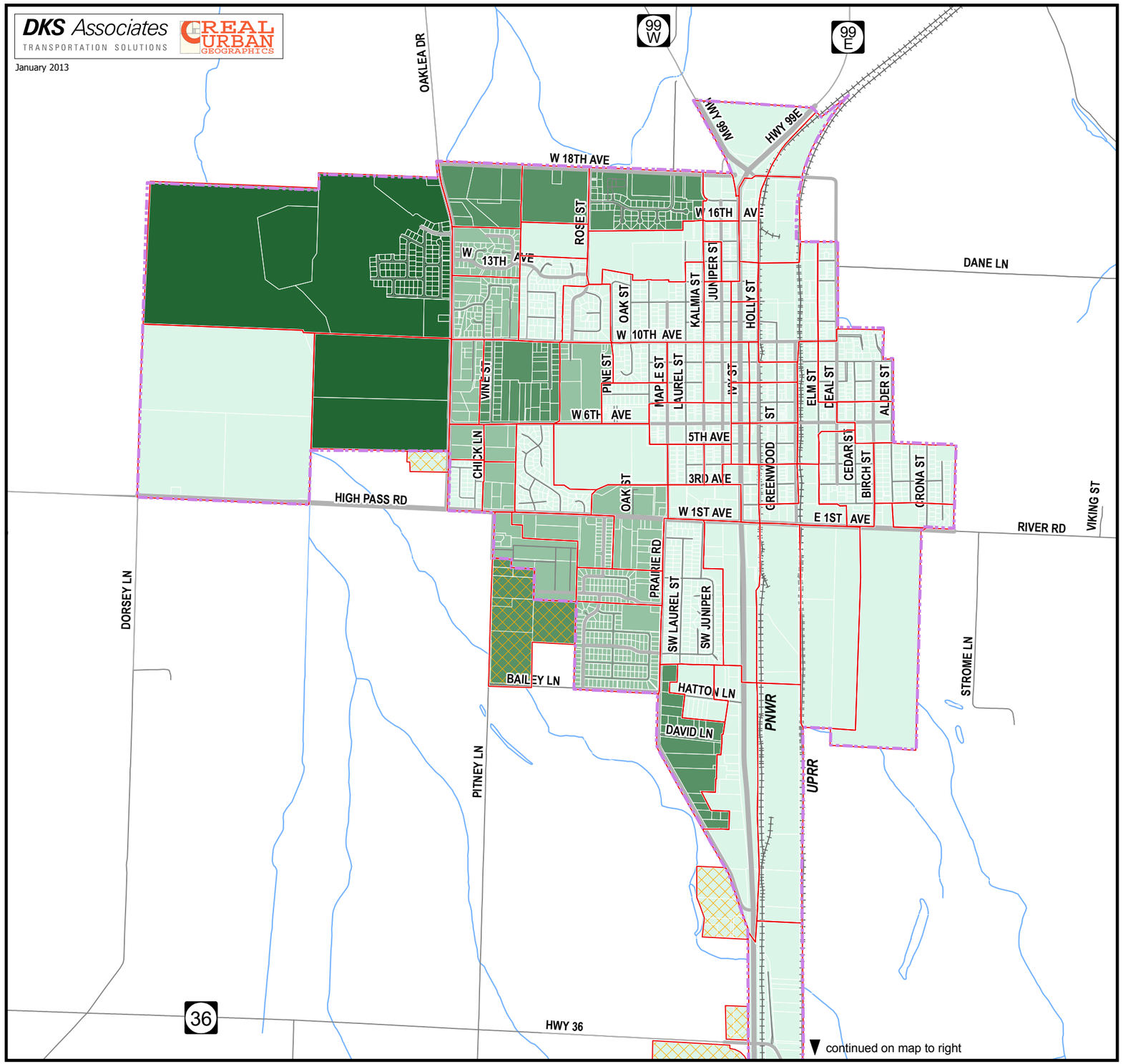
January 2013

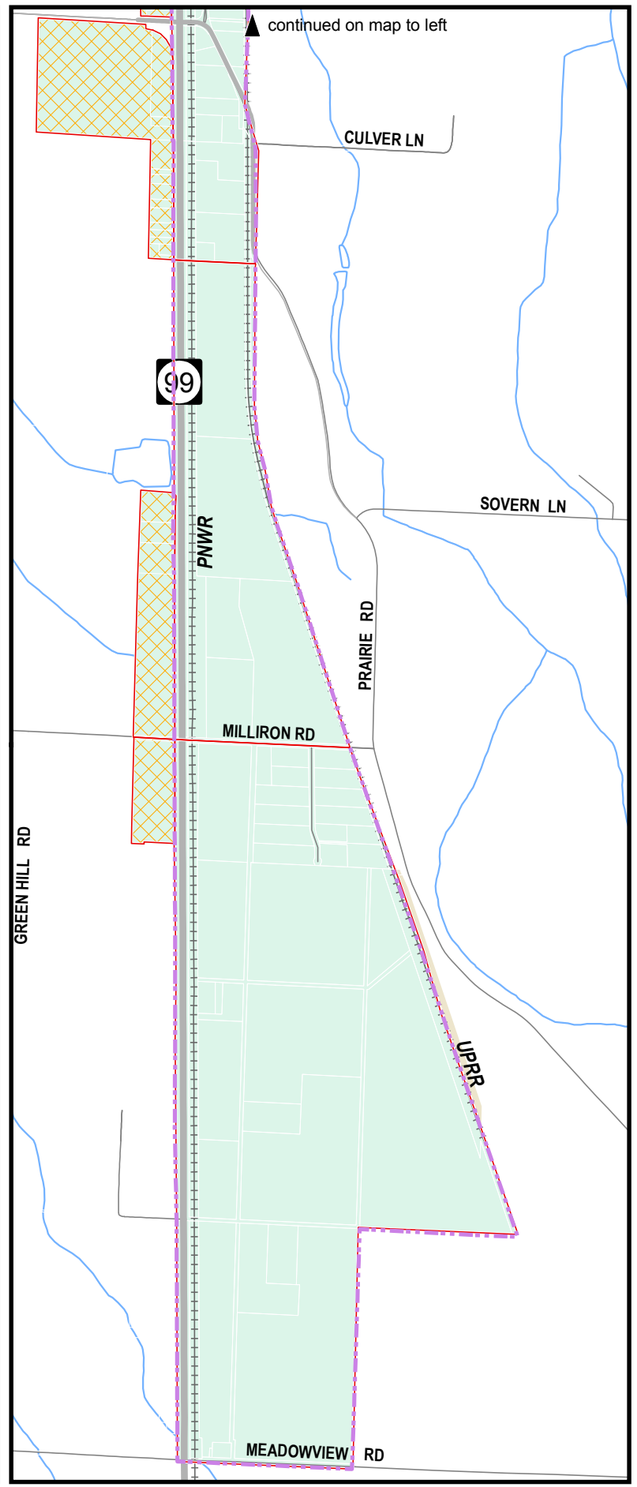
Junction City

Transportation System Plan

FIGURE 1

Household Growth (2010-2035)





Legend

Household Growth, 2010-2035 (Number of Households)

- LESS THAN 10
- 10 - 49
- 50 - 199
- MORE THAN 200
- TRANSPORTATION ANALYSIS ZONE (TAZ) BOUNDARY
- UGB EXPANSION AREA

Roadways

- ARTERIAL
- COLLECTOR
- LOCAL STREET
- 2010 URBAN GROWTH BOUNDARY
- TAX LOTS
- RAILROAD
- STREAM

N W E S

0 1,000 2,000 Feet

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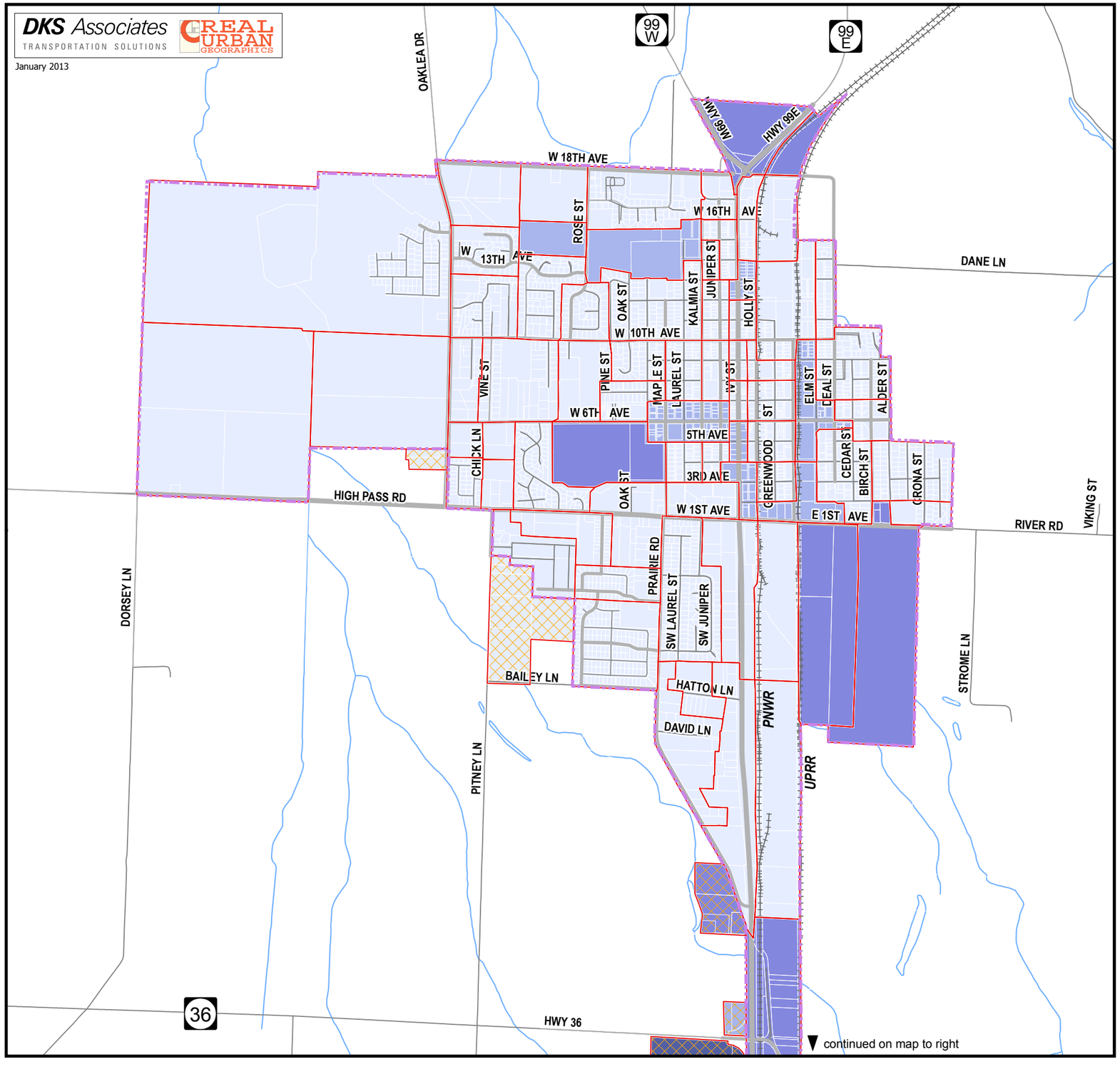
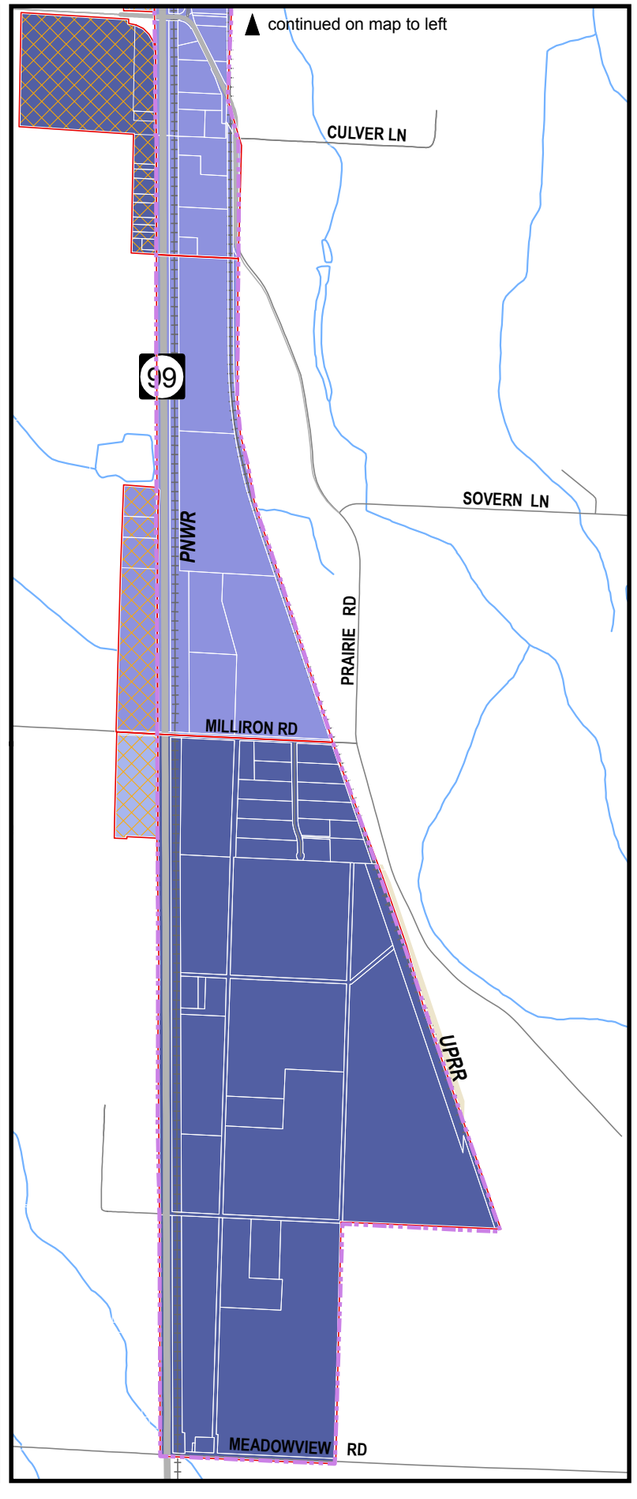
Junction City

Transportation System Plan

FIGURE 2

Employment Growth (2010-2035)





Legend

Employment Growth, 2010-2035 (Number of Employees)

- LESS THAN 10
- 10 - 49
- 50 - 199
- MORE THAN 200
- TRANSPORTATION ANALYSIS ZONE (TAZ) BOUNDARY
- UGB EXPANSION AREA

Roadways

- ARTERIAL
- COLLECTOR
- LOCAL STREET
- 2010 URBAN GROWTH BOUNDARY
- TAX LOTS
- RAILROAD
- STREAM

N W E S

0 1,000 2,000 Feet

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Junction City

Transportation System Plan

FIGURE 3

2035
PM Peak Hour
Traffic Volumes

Legend

- STUDY INTERSECTION

Roadways
- ARTERIAL
- COLLECTOR
- LOCAL STREET

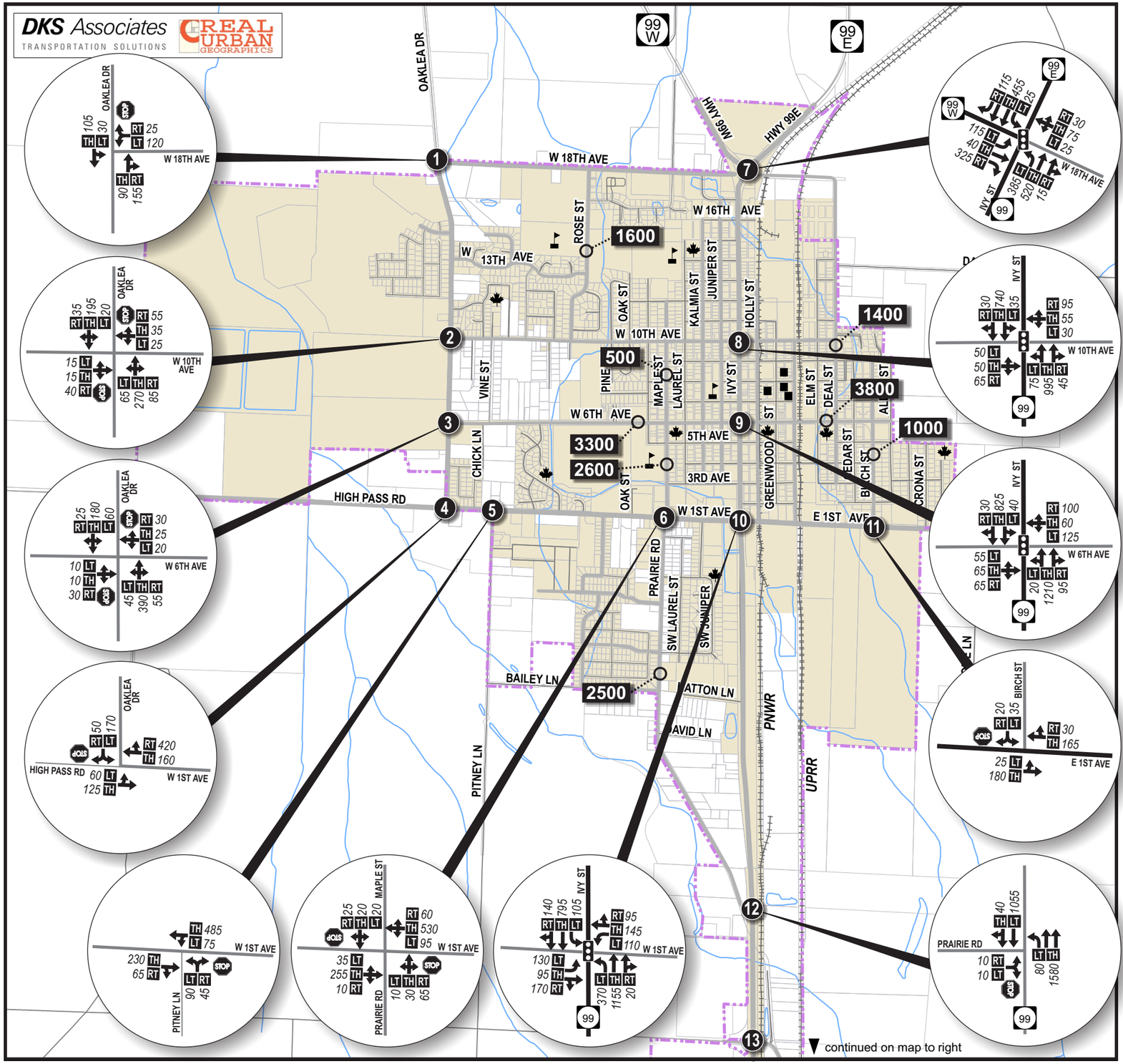
General
- CITY LIMITS
- URBAN GROWTH BOUNDARY
- TAX LOTS
- RAILROAD
- STREAM

Traffic Volume Data
- STOP STOP SIGN
- TRAFFIC SIGNAL
- LANE CONFIGURATION
- 000 PM PEAK HOUR TRAFFIC VOLUME
- LT TH RT Left•Thru•Right VOLUME TURN MOVEMENT
- 000 WEEKDAY AVERAGE DAILY TRAFFIC

Places of Interest
- CIVIC/GOV'T
- PARK
- SCHOOL

N W E S

0 1,000 2,000 Feet



FUTURE TRAFFIC OPERATIONS

The 2035 design hour traffic volumes were analyzed at the study intersections, with the results compared to applicable mobility targets/standards, as identified in Chapter 3. The results of the traffic analysis are shown in Table 2 and detailed analysis worksheets can be found in Appendix C.

As shown below, while traffic volumes and congestion will increase citywide, nearly all study intersections will continue to meet mobility standards. The only exception is the High Pass Road/Maple Street intersection, where the southbound Maple Street approach will experience relatively long delays.

TABLE 2: Future (2035) Weekday PM Peak Hour Intersection Operations

Intersection (North-South / East-West)	**Jurisdiction**	**Mobility Target**	**Intersection Performance**		
			Delay (sec)	*LOS*	*V/C*
Oaklea Dr. / 18th Ave.	Lane County	0.75 V/C or LOS D	12.4	A/B	0.25
Oaklea Dr. / 10th Ave.	Lane County	0.75 V/C or LOS D	18.8	A/C	0.33
Oaklea Dr. / 6th Ave.	Lane County	0.75 V/C or LOS D	21.3	A/C	0.27
Oaklea Dr. / 1st Ave. – High Pass Rd.	Lane County	0.75 V/C or LOS D	21.8	A/C	0.53
Pitney Ln. / 1st Ave. – High Pass Rd.	Lane County	0.75 V/C or LOS D	23.9	A/C	0.44
Prairie Rd.-Maple St. / 1st Ave.-High Pass Rd.	Junction City/ Lane County	0.85 V/C or LOS D	36.5	A/E	0.38
OR 99E / OR 99W	ODOT	0.85 V/C	18.3	B	0.62
OR 99 / 10th Ave.	ODOT	0.90 V/C	12.2	B	0.64
OR 99 / 6th Ave.	ODOT	0.90 V/C	16.1	B	0.75
OR 99 / 1st Ave.	ODOT	0.90 V/C	33.2	C	0.75
Birch St. / 1st Ave. – River Rd.	Junction City/ Lane County	0.85 V/C or LOS D	11.9	A/B	0.12
OR 99 / Prairie Rd.	ODOT	0.90 V/C*	21.2	A/C	0.49
OR 99 / OR 36	ODOT	0.85 V/C	23.5	C	0.74
OR 99 / Milliron Rd	ODOT	0.85 V/C	10.7	B	0.61

Signalized Intersection:
Delay = Average Intersection Delay (sec.)
LOS = Level of Service
V/C = Volume to Capacity Ratio
Shaded values do not meet standards

Unsignalized Intersection:
Delay = Critical Movement Approach Delay (sec.)
LOS = Major Street LOS / Minor Street LOS
V/C = Critical Movement Volume to Capacity Ratio
Note: LOS for all-way stop intersections reported for entire intersection
* Mobility target shown is for stopped minor street approaches

Another issue that may affect traffic operations and safety in the future is the manner in which property access is taken from OR 99 south of 1st Avenue where posted speeds are 45 mph or higher. Between 1st Avenue and Prairie Road, there are a number of existing commercial businesses with closely spaced driveways that create the potential for confusion and conflicting turns. In addition, the recent UGB expansion has created a number of individual commercial lots between OR 36 and Milliron Road that have no means of access other than directly to OR 99. As transportation solutions are considered for the TSP, a plan for establishing access to these properties that lessens the potential for conflicts should be explored. This could include strategies such as taking access from new roads in front of or behind the properties (which may be difficult due to shallow properties and challenges with phased construction) or establishing shared access points to reduce the overall number of conflict areas.

FUTURE BICYCLE, PEDESTRIAN, AND TRANSIT NEEDS

For the assessment of future transportation needs, it is assumed that no improvements are made to existing conditions. Therefore, the needs identified under existing conditions (see Chapter 3) would generally continue to be needed in the future. However, with new areas of development within the urban growth boundary and increased traffic volumes on the street network, some new issues would emerge.

For bicycles and pedestrians, the need to infill existing gaps and improve street crossing opportunities will continue to exist. The Junction City Parks, Open Space, and Trails Master Plan includes proposed future off-street trails and on-street bike routes that should in included in the TSP. Future street extensions into areas of new development would include sidewalks and appropriate bicycle facilities, but improvements along key existing routes will be critical for completing connections to activity generators. Furthermore, projected motor vehicle traffic increases on OR 99, Prairie Road, High Pass Road, Oaklea Drive, and 18th Avenue will elevate the importance of separate walking and cycling facilities (i.e., separate from the auto travel lanes, which could include sidewalk and bike lanes) on those routes.

New areas of development within the city may also change demands for transit services. In addition to the increased potential demand for paratransit and ridesharing services, new demand for the fixed Route 95 line could drive a need for increased frequency of service or changes in the route alignment to enhance accessibility.

FUTURE FUNDING AVAILABILITY

Projecting the revenue anticipated to be available for future capital projects helps to provide an understanding of the city's capacity for constructing the transportation improvement projects to support growth. Future estimates for Junction City's transportation funding through the year 2035 are summarized in Table 3. These projections include estimated resources available based on the amount of revenue collected in the past from current funding sources and assumptions for growth in land development through the planning horizon. Estimated expenditures are based on historical data of costs associated with maintaining the existing transportation system. These expenditures are subtracted from the total estimated revenues to calculate the net balance available for capital improvement projects. As shown, the city may have approximately $2.4

million available for capital improvements through 2035. It should be noted that this does not include any one-time or project-specific funding grants or other non-routine sources of revenue from other jurisdictions.

TABLE 3: Estimate of Funding Availability Through 2035

RESOURCES	Annual Average	25 Year Total
OR Gas Tax - Bike Component	$2,300	$57,500
OR Gas Tax - Streets Component	$220,700	$5,517,500
Sidewalk Permits	$2,560	$64,000
System Development Fees	$120,800	$3,020,000
Fund Balance (Current Existing)	NA	$1,178,000
		$9,837,000

EXPENDITURES	Annual Average	25 Year Total
Personnel (Wages, Benefits, Etc.)	$164,700	$4,117,500
Equipment, Materials, & Services	$125,200	$3,130,000
Street Maintenance & Repairs	$8,200	$205,000
		$7,452,500
Available Balance for Capital Improvement Projects		**$2,384,500**

SUMMARY OF KEY FINDINGS

Based on the evaluation of future conditions through the year 2035, the following key findings were identified for consideration during the development of transportation solutions for the city. This list is intended to supplement, not replace, the summary of findings for existing conditions (see Chapter 3).

Pedestrian

- Improving existing pedestrian facility gaps and crossings on key routes will be critical for connecting future growth areas in the west and south to activity generators within the city.
- Separate walking facilities will be needed on higher volume streets such as OR 99, Prairie Road, High Pass Road, Oaklea Drive, and 18th Avenue.
- Future street extensions into new growth areas must include continuous sidewalks.

Bicycle

- Improving existing bicycle facility gaps and crossings on key routes will be critical for connecting future growth areas in the west and south to activity generators within the city.

- Separate cycling facilities (which could include bike lanes) will be needed on higher volume streets such as OR 99, Prairie Road, High Pass Road, Oaklea Drive, and 18th Avenue.
- Future street extensions into new growth areas must include appropriate accommodations for cycling. For new arterial and collector streets, construction of bike lanes is required by both the city and county.

Transit

- As future development occurs, the need to increase transit services or modify routes must be monitored. Funding for enhanced services should be considered during the development of solutions for the TSP.

Motor Vehicle

- The southbound approach of Maple Street with the intersection on High Pass Road will experience relatively long delays during the weekday p.m. peak hour in the year 2035 and would not meet the County's mobility standard.
- Street extensions will be needed to serve new areas of development, providing a framework of arterial and collector roadways.
- Maintaining safe access to highway adjacent properties on OR 99 south of 1st Avenue may become more challenging in the future as traffic volumes increase.

Appendix A: Land Use Data by TAZ

2035 Land Use by TAZ

TAZ			Household Type								Employment Type				
Number	Total Households	Total Employment	Accessory Dwelling Units	Manufactured Homes	Single Family Housing	Duplex or Small Lot SF (2 units)	Triplexes (3 units)	Quadplexes (4 units)	Apartments	Manufactured Homes (Park)	Government	Retail	Office	Other Services	Industrial
1	**1**	**94**	0	0	1	0	0	0	0	0	0	34	30	30	0
2	**0**	**60**	0	0	0	0	0	0	0	0	0	0	0	0	60
3	**1**	**128**	0	0	1	0	0	0	0	0	0	109	0	0	19
4	**233**	**121**	0	0	41	15	0	0	162	0	22	54	28	17	0
5	**108**	**0**	0	0	33	0	0	0	75	0	0	0	0	0	0
6	**148**	**0**	2	0	22	51	0	0	0	22	0	0	0	0	0
7	**0**	**66**	0	0	0	0	0	0	0	0	66	0	0	0	0
8	**69**	**0**	0	0	69	0	0	0	0	0	0	0	0	0	0
9	**90**	**0**	0	0	90	0	0	0	0	0	0	0	0	0	0
10	**95**	**0**	4	1	84	3	0	0	0	0	0	0	0	0	0
11	**46**	**0**	1	0	45	0	0	0	0	0	0	0	0	0	0
12	**0**	**94**	0	0	0	0	0	0	0	0	0	0	0	0	94
13	**0**	**94**	0	0	0	0	0	0	0	0	0	0	0	0	94
14	**1**	**98**	0	0	1	0	0	0	0	0	0	18	40	40	0
15	**1**	**160**	0	0	1	0	0	0	0	0	66	0	0	0	94
16	**1**	**127**	0	0	1	0	0	0	0	0	0	72	0	17	38
17	**0**	**90**	0	0	0	0	0	0	0	0	90	0	0	0	0
18	**41**	**87**	2	1	27	2	0	0	7	0	0	36	28	23	0
19	**111**	**0**	0	1	106	2	0	0	0	0	0	0	0	0	0
20	**14**	**106**	0	0	14	0	0	0	0	0	0	72	0	34	0
21	**12**	**44**	0	0	12	0	0	0	0	0	0	0	28	16	0
22	**0**	**107**	0	0	0	0	0	0	0	0	0	91	0	16	0
23	**11**	**296**	0	0	7	2	0	0	0	0	66	127	40	25	38
24	**0**	**107**	0	0	0	0	0	0	0	0	0	91	0	16	0
25	**6**	**55**	0	0	6	0	0	0	0	0	0	18	0	18	19
26	**4**	**144**	0	0	1	0	1	0	0	0	0	60	28	18	38
27	**0**	**135**	0	0	0	0	0	0	0	0	0	62	43	30	0
28	**38**	**43**	0	0	17	5	0	0	0	11	0	0	27	16	0
29	**0**	**148**	0	0	0	0	0	0	0	0	0	108	12	28	0
30	**50**	**0**	0	0	50	0	0	0	0	0	0	0	0	0	0
31	**30**	**111**	0	0	15	0	0	0	15	0	0	4	56	51	0
32	**64**	**161**	1	0	41	3	2	1	6	0	44	26	28	63	0
33	**21**	**20**	5	0	16	0	0	0	0	0	0	0	14	6	0
34	**0**	**157**	0	0	0	0	0	0	0	0	0	108	15	34	0
35	**41**	**0**	0	0	31	5	0	0	0	0	0	0	0	0	0
36	**159**	**0**	3	17	70	11	3	3	26	0	0	0	0	0	0
37	**78**	**90**	0	0	2	0	1	3	61	0	0	0	56	34	0
38	**95**	**0**	0	0	91	2	0	0	0	0	0	0	0	0	0
39	**41**	**0**	0	0	18	0	0	0	0	23	0	0	0	0	0
40	**92**	**0**	4	0	68	10	0	0	0	0	0	0	0	0	0
41	**46**	**8**	3	1	42	0	0	0	0	0	0	0	0	8	0
42	**141**	**0**	0	5	92	22	0	0	0	0	0	0	0	0	0
43	**100**	**0**	1	0	6	0	0	0	30	63	0	0	0	0	0
44	**49**	**0**	0	0	29	10	0	0	0	0	0	0	0	0	0
45	**52**	**0**	1	0	43	4	0	0	0	0	0	0	0	0	0
46	**33**	**0**	0	0	31	1	0	0	0	0	0	0	0	0	0
47	**0**	**110**	0	0	0	0	0	0	0	0	110	0	0	0	0
48	**232**	**80**	0	1	8	0	0	0	179	44	0	18	28	34	0
49	**40**	**0**	0	1	25	7	0	0	0	0	0	0	0	0	0
50	**101**	**0**	0	0	1	0	0	0	28	72	0	0	0	0	0
51	**59**	**0**	0	1	58	0	0	0	0	0	0	0	0	0	0
52	**91**	**0**	0	0	91	0	0	0	0	0	0	0	0	0	0
53	**26**	**0**	0	0	26	0	0	0	0	0	0	0	0	0	0
54	**42**	**0**	1	1	40	0	0	0	0	0	0	0	0	0	0
55	**36**	**0**	0	0	36	0	0	0	0	0	0	0	0	0	0
56	**35**	**0**	0	0	35	0	0	0	0	0	0	0	0	0	0
57	**181**	**0**	0	0	139	1	0	10	0	0	0	0	0	0	0
58	**112**	**0**	0	0	112	0	0	0	0	0	0	0	0	0	0
59	**152**	**0**	0	1	89	31	0	0	0	0	0	0	0	0	0
60	**182**	**36**	1	0	4	0	0	0	177	0	0	36	0	0	0
61	**9**	**174**	0	0	9	0	0	0	0	0	0	0	0	0	174
62	**0**	**235**	0	0	0	0	0	0	0	0	0	0	0	0	235
63	**1**	**1950**	0	0	1	0	0	0	0	0	1798	0	0	16	136
64	**0**	**218**	0	0	0	0	0	0	0	0	0	0	0	0	218
65	**0**	**50**	0	0	0	0	0	0	0	0	0	0	0	0	50
66	**0**	**19**	0	0	0	0	0	0	0	0	0	0	0	0	19
67	**0**	**122**	0	0	0	0	0	0	0	0	0	36	0	0	86
68	**0**	**66**	0	0	0	0	0	0	0	0	0	36	14	16	0
69	**0**	**72**	0	0	0	0	0	0	0	0	0	72	0	0	0
70	**0**	**112**	0	0	0	0	0	0	0	0	0	0	0	0	112
71	**22**	**54**	0	0	0	0	0	0	0	22	0	54	0	0	0
72	**489**	**0**	1	0	377	32	0	0	47	0	0	0	0	0	0
73	**0**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0
74	**306**	**0**	0	0	197	0	10	0	79	0	0	0	0	0	0
2010 UGB															
Totals	**4239**	**6249**	**30**	**31**	**2472**	219	17	17	**892**	**257**	**2262**	**1342**	**515**	**606**	**1524**
Control	**NA**	**NA**				**438**	**51**	**68**			**NA**	**NA**	**NA**	**NA**	**NA**
75	**3**	**0**	0	0	3	0	0	0	0	0	0	0	0	0	0
76	**197**	**0**	0	0	9	73	0	0	42	0	0	0	0	0	0
77	**1**	**149**	0	0	1	0	0	0	0	0	0	100	45	4	0
78	**0**	**52**	0	0	0	0	0	0	0	0	0	40	6	6	0
79	**9**	**614**	0	0	9	0	0	0	0	0	0	261	186	167	0
80	**5**	**116**	0	0	5	0	0	0	0	0	0	60	30	26	0
81	**1**	**60**	0	0	1	0	0	0	0	0	0	20	5	35	0
2035 UGB															
Totals	**4455**	**7240**	**30**	**31**	**2500**	292	17	17	**934**	**257**	**2262**	**1823**	**787**	**844**	**1524**
Control	**4455**	**7240**				**584**	**51**	**68**			**2262**	**1823**	**787**	**844**	**1524**

Appendix B: Travel Forcasting Tool

DRAFT AMENDED TECHNICAL MEMORANDUM #3

TO: Project Management Team

FROM: John Bosket, P.E.
Mat Dolata, P.E.

DATE: January 8, 2013

SUBJECT: **Junction City TSP Update**
Travel Forecasting Tool Development P09042-010-003

This memorandum documents the land use and transportation network assumptions used as a basis for forecasting with the enhanced cumulative analysis tool. This tool has been developed in conjunction with the Junction City Transportation System Plan (TSP) update to provide traffic volume forecasts for the 2035 TSP horizon year.

Forecast Development Process

The development of the enhanced cumulative analysis tool was completed incrementally, with PMT review and approval sought at the conclusion of each stage. This process is described in the project Statement of Work and summarized below. The Project Management Team (PMT) has previously reviewed and approved Technical Memorandum #2 (Traffic Forecasting Methods and Assumptions) and reviewed and provided commentary on Draft Technical Memorandum #3 (Travel Forecasting Tool Development). Draft Technical Memorandum #3 identified network assumptions and 2010 land use, however future year land use assumptions could not be provided due to the ongoing Junction City Comprehensive Plan Amendment process. The Revised Technical Memorandum #3 incorporated the Junction City Comprehensive Plan Amendment into the 2035 land use assumptions, including adopted expansion areas. The estimated trips and calibration results of the enhanced cumulative analysis tool were summarized and the resulting 2035 volume forecasts were reviewed and approved by the PMT.

Table 1: Traffic Forecasting Documents and Status

Document / Deliverable for Review	Purpose / Subject	Status
Technical Memorandum #2	Gain approval for general methods and assumptions proposed for the development of the enhanced cumulative analysis tool to be used for traffic forecasting.	Approved
Technical Memorandum #3	Gain approval of transportation network assumptions, transportation analysis zone boundaries, and	Revised &

	household/employment allocations for the existing (2010) and future (2035) year scenarios.	Approved
Revised / Expanded Technical Memorandum #3	Gain approval of existing (2010) and future (2035) year trip assumption and verification of existing year scenario calibration.	Revised & Approved
Draft Amended Technical Memorandum #3	Revise future (2035) year land use, trip tables, and traffic volume forecasts.	Submitted

The Amended Technical Memorandum #3 reflects revisions made to the Junction City Comprehensive Plan in 2012. The revisions result in updated land use assumptions that form the basis of traffic volume forecasts. The following sections of this memorandum detail each component of the proposed travel forecast methodology associated with the enhanced cumulative analysis tool, as was defined in Technical Memorandum #2.

Roadway Network

The roadway network included in the Junction City TSP VISUM model consists of all local, collector, and arterial streets within the existing Junction City UGB. In addition, because there are routing alternatives outside of the Junction City UGB, the model includes roadways surrounding Junction City that serve local traffic.

The purpose of the existing conditions network is to configure the model and act as a base in the development of the future model. The existing roadway network was built using NAVTEQ files as the initial base, with modifications made to match real world conditions based on an existing conditions inventory. Elements of that inventory will be provided in the TSP Existing Conditions chapter and include posted speeds, traffic controls, lane geometries, and number of travel lanes. The existing conditions (2010) network is depicted in Figure 1.

The 2035 future year baseline roadway network has been developed to include identified capacity-related improvements that are already planned for construction in the near future. These projects, as well improvements to be added as part of known development plans, will be included in the future No-Build network. The 2035 future year network will be further adjusted and used to perform analysis of the various transportation alternatives and improvements analyzed for the Junction City TSP update.

All modifications to the Junction City 2035 roadway network were identified from the Junction City State Hospital/Correctional Facility Transportation Impact Analysis[1]. The projects include traffic signals and additional turn lanes at the intersections of OR 99 & Miliron Road and OR 99 & Meadowview Road. Other future projects identified for Junction City are bicycle, pedestrian,

[1] Junction City State Hospital/Correctional Facility Transportation Impact Analysis, DKS Associates, March 2009

or roadway modernization projects. These projects are not incorporated into the model because they are not expected to increase motor vehicle capacity or travel speeds relative to existing conditions.

Transportation Analysis Zones

For transportation modeling purposes, the Junction City UGB was divided into transportation analysis zones (TAZs), representing the sources of vehicle trip generation within the city. The TAZ structure is based on a combination of the existing roadway network, land use data, UGB, zoning, and comprehensive plan designations. The TAZ system was developed by using the previous Junction City travel demand model[2] as a starting point. However, significant modifications were made to create a more detailed TAZ structure. The TAZ system defined for the network includes 74 zones within the current UGB and 7 zones identified for future expansion. The Junction City TSP VISUM network also includes eight external TAZs at the key gateways into and out of the city (as well as outlying residential areas) to account for vehicle trips that enter and exit the Junction City UGB. The 81 zone system and external zones are illustrated in Figure 2.

Land Use

Land use is a key factor affecting the traffic demands placed on Junction City's transportation system. The location, density, type, and mixture of land uses have a direct impact on traffic levels and patterns. An inventory of existing land uses and future (2035) land use projections identifies existing and future land uses for each TAZ in the Junction City UGB.

Existing and future land use totals for Junction City were obtained from several sources. The household estimates are based on the Lane County coordinated population forecasts for the Junction City UGB,[3] the estimated growth in households, the number of residents in households and group quarters,[4] and average household size.[5] The employment totals for 2010 and 2035 are scaled based on employment estimates for 2009, 2029, 2039, and 2059.[6] The scaling is performed by calculating rates of annual growth between base and future years[7]. Land use totals for the Junction City UGB are identified below.

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[2] 2006 base model and 2026 future model developed by LCOG

[3] Population Forecasts for Lane County, its Cities, and Unincorporated Area 2008-2035, Portland State University Population Research Center, May 2009 as adopted by Lane County, Ordinance PA 1255 (June 17, 2009).

[4] Draft Housing Element, Junction City Comprehensive Plan, City of Junction City, June 2012

[5] Although the most recent Draft Housing Element assumes 2.43 persons per household in existing households, 2.47 persons per household was assumed in the 2010 land use allocation. The difference is insignificant to traffic growth projections, therefore the 2.47 persons per household assumption was retained for the base year housing estimate. Data Source: U.S. Census Bureau, 2010 Census Redistricting Data. Retrieved April 2011.

[6] Draft Commercial and Industrial Buildable Lands Inventory and Economic Opportunities Analysis, ECONorthwest & Winterbrook Planning, June 2009.

[7] Employment in 2010 is estimated based on compound growth rates calculated between 2009 and 2029 for various employment types (Industrial, Office, Retail, Other Service, and Government). The estimates took into consideration an anticipated increase of 1,800 employees between 2012 to 2019 from the State Prison and Hospital. Employment in 2035 is estimated by modifying identified growth rates by employment type calculated between 2029 and 2059 to match the employment total identified for 2039

Table 2: Land Use Totals (UGB)

Year	Households	Employment
2010	2,582	3,545
2035*	4,455	7,240
Growth (2035-2010)	1,862	3,695

*2035 UGB includes Comprehensive Plan expansion areas.

Using 2008 aerial photography and 2011 tax assessor data, Winterbrook Planning allocated the land use totals for the 2010 base model to the identified TAZ system. The employment total is composed of government employment, retail employment, office employment, industrial employment, and other services employment. The households total is classified into single family housing units, multi-family housing units, and apartments.

The future 2035 land use allocation estimates the amount of each land use that each TAZ will accommodate based on expected build-out of vacant or underdeveloped lands and assuming Comprehensive Plan zoning. The future year land use allocations were developed by Winterbrook Planning with revisions provided by the PMT to reflect local knowledge. The household and employment totals for TAZs are consistent with the citywide forecasts identified in Table 2. Detailed land use data by TAZ is attached in the Appendix.

Travel Demand

Travel demand on roadways and at intersections in Junction City has been estimated using methodology similar to that specified by the ODOT Procedures Manual for cumulative analysis models (often referred to as Level 2 models).[8] Adjustments made to the methodology included modeling all vehicle trips (not just growth increment), adjusting the trip distribution to reduce household-to-household trips, and using VISUM modeling software to perform the trip assignment. Travel demand has been estimated at 30th highest hour conditions for the years 2010 and 2035. The purpose of the 2010 model is to calibrate the network in preparation for developing the 2035 model network, which will be used for the future analysis.

The travel demand analysis includes the translation of City land use information into motor vehicle trips. This was done for each of the Junction City TAZs based on the existing and projected land uses described previously in the Land Use section of this memorandum. Trips traveling to and from the external TAZs were estimated for both the 2010 and 2035 analysis years.

(employment by type was undefined for 2039). The calculation sheet used to interpolate employment totals by year is attached in the Appendix.

[8] *Analysis Procedures Manual (APM)*, Oregon Department of Transportation (ODOT) Transportation Planning Analysis Unit (TPAU), Last Updated January 2011, pgs. 4-31 to 4-43

Trip Types

Travel demand projections involve the determination of three distinct types of trips:

- **External-External (E-E) Trips** do not have an origin or destination in Junction City and either do not stop or only make a very minor stop while passing through the Junction City UGB. These trips are typically referred to as through traffic.
- **Internal-External (I-E) Trips** originate in Junction City and are traveling to a location outside of the Junction City UGB and **External-Internal (E-I) Trips** originate outside of the Junction City UGB and are traveling to a location within Junction City.
- **Internal-Internal (I-I) Trips** travel from one location within the Junction City UGB to another location within the UGB.

External Trip Ends

External trip ends consist of through trips (i.e., E-E trips) as well as trips that enter or leave Junction City (i.e., I-E and E-I trips). The number of 2010 external trip ends was based on existing traffic volumes (30th highest hour conditions) at key gateways to the City, which include OR 99W and OR 99E to the north, OR 99 to the south, OR 36 and High Pass Road to the west, and River Road to the east (as well as additional roads connecting to outlying residential areas).

The proportion of each external trip type, specifically determining the portion of E-E through trips, was estimated based on the collection of origin-destination Bluetooth device data, the traffic counts, and the previous Junction City travel demand model. The Bluetooth device data was collected at the major gateways (OR 99W north of Oaklea Drive, OR 99E north of Link Lane, OR 99 south of Meadowview Road, and OR 36 west of Dorsey Lane) in April, 2011. The process for converting blue-tooth data into external trip distributions is illustrated in the Appendix. The previous Junction City travel demand model was used to verify the blue tooth results and supplement data for external locations where blue-tooth data was not collected.

Future external trip end quantities were estimated based on the existing traffic volumes and forecasted growth at the external gateways. Forecasted external growth was primarily based on the ODOT (2030) Highway Future Volume Table. The volumes and annual growth rates applied to entering and exiting trips at external locations are included in the Appendix.

Internal Trip Ends

The number of internal trip ends in Junction City was determined using land use trip generation methodology, which translates land use quantities (number of dwelling units or number of employees) into vehicle trip ends (number of vehicles entering or leaving a TAZ) using land use-specific trip generation rates. These rates were initially based on national rates obtained from the Institute of Transportation Engineers (ITE) *Trip Generation, 8th Edition*[9], with adjustments made to trip rates to reflect local travel patterns based on existing vehicle count data.

[9] *Trip Generation Manual*, 8th Edition, Institute of Transportation Engineers, 2010.

By applying the trip generation rates to the TAZ land uses, the number of trips entering and exiting each TAZ was estimated for both the existing year 2010 land uses and the projected year 2035 land uses. Trip generation for each TAZ in 2010 and 2035 is summarized in the Appendix.

Trip Distribution

Trip distribution determines how many trips travel between each of the internal and external TAZs. The external trips passing through Junction City were distributed based on the O-D survey and the Junction City travel demand model, as discussed previously in the External Trip Ends section of this memorandum. Distribution for trips traveling to and from internal zones (i.e., trips having at least one internal trip end) was based on weighting the attractiveness of each zone, as measured by the number of trip ends generated by the zone. Separate weighting percentages were used for household and non-household trip ends to avoid yielding a disproportionate number of household-to-household trips during the PM peak hour.

Trip Assignment

Trip assignment involves the determination of the specific travel routes taken by all of the trips within the transportation network. This step was performed using VISUM modeling software. The forecast tool inputs include the transportation network (i.e., road and intersection locations and characteristics, as determined from maps and field inventories) and a trip distribution table (determined using methodology described previously in this memorandum). Iterated assignment was then performed using estimated travel times along roadways and delays at intersection movements.[10] The path choice for each trip was based on minimal travel times between locations.

Calibration

Calibration was performed on the 2010 base year forecasting tool by comparing modeled volumes at the Junction City TSP study intersections with existing 2010 traffic volumes (i.e., 30th highest hour conditions). A plot comparing the existing traffic counts and the base year forecast tool volumes for all study intersection turn movements is attached in the Appendix. The slope of the fitted curve is 1.097 and R^2 value of the plotted data is 0.983. These measures indicate that the forecasting tool reasonably represents existing traffic volume patterns in Junction City.

Model Volumes

Model output volume plots are be provided in the Appendix for the 2010 base year, for the 2035 future year, and the increment of traffic growth between 2010 and 2035 during the PM peak hour. Future year design hour volumes consider the model for both the base year 2010 and forecast year 2035 scenarios. A "post processing" technique following NCHRP 255 methodology[11] was utilized to refine model travel forecasts to the volume forecasts utilized for

[10] Roadway travel times were calculated based on distance and travel speed. Intersection movement delays were calculated using Highway Capacity Manual (HCM) methodology for signalized and unsignalized intersections. Detailed lane geometry, traffic control, roadway cross-section, and roadway travel speed information is required for model accuracy.

[11] *Highway Traffic Data for Urbanized Area Project Planning and Design - National Cooperative Highway Research Program Report 255*, Transportation Research Board, Washington D.C., 1982.

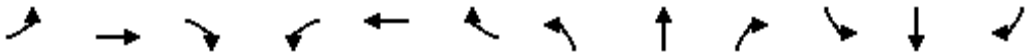
2035 intersection analysis. Revised future 2035 turn movement projections are provided in the attached Appendix.

Appendix C: 2035 Future No-Build Capacity Analysis - Synchro Output

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	120	25	90	155	30	105
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	133	28	100	172	33	117
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	369	186			272	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	369	186			272	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	78	97			97	
cM capacity (veh/h)	615	848			1303	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	161	272	150
Volume Left	133	0	33
Volume Right	28	172	0
cSH	645	1700	1303
Volume to Capacity	0.25	0.16	0.03
Queue Length 95th (ft)	25	0	2
Control Delay (s)	12.4	0.0	1.9
Lane LOS	B		A
Approach Delay (s)	12.4	0.0	1.9
Approach LOS	B		

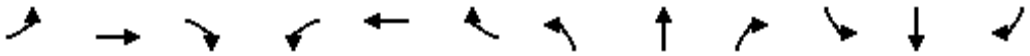
Intersection Summary			
Average Delay	3.9		
Intersection Capacity Utilization	42.1%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	15	15	40	25	35	55	65	270	85	20	195	35
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	17	17	44	28	39	61	72	300	94	22	217	39
Pedestrians					1							
Lane Width (ft)					12.0							
Walking Speed (ft/s)					4.0							
Percent Blockage					0							
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	853	820	236	826	793	348	256			395		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	853	820	236	826	793	348	256			395		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	92	94	94	89	87	91	94			98		
cM capacity (veh/h)	217	287	803	250	298	699	1309			1173		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	78	128	467	278
Volume Left	17	28	72	22
Volume Right	44	61	94	39
cSH	408	388	1309	1173
Volume to Capacity	0.19	0.33	0.06	0.02
Queue Length 95th (ft)	17	35	4	1
Control Delay (s)	15.9	18.8	1.7	0.8
Lane LOS	C	C	A	A
Approach Delay (s)	15.9	18.8	1.7	0.8
Approach LOS	C	C		

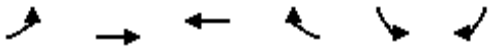
Intersection Summary				
Average Delay	4.9			
Intersection Capacity Utilization	56.7%	ICU Level of Service	B	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	10	10	30	20	25	30	45	390	55	60	180	25
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.90	0.92	0.90	0.92	0.90	0.90	0.90	0.90	0.92
Hourly flow rate (vph)	11	11	33	22	27	33	49	433	61	67	200	27
Pedestrians					1							
Lane Width (ft)					12.0							
Walking Speed (ft/s)					4.0							
Percent Blockage					0							
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	956	940	214	948	923	465	227			495		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	956	940	214	948	923	465	227			495		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	94	95	96	89	89	94	96			94		
cM capacity (veh/h)	191	238	826	208	244	601	1341			1078		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	54	83	543	294
Volume Left	11	22	49	67
Volume Right	33	33	61	27
cSH	382	302	1341	1078
Volume to Capacity	0.14	0.27	0.04	0.06
Queue Length 95th (ft)	12	27	3	5
Control Delay (s)	16.0	21.3	1.1	2.4
Lane LOS	C	C	A	A
Approach Delay (s)	16.0	21.3	1.1	2.4
Approach LOS	C	C		

Intersection Summary				
Average Delay	4.0			
Intersection Capacity Utilization	44.7%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	60	125	160	420	170	50
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	63	132	168	442	179	53
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	611				647	389
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	611				647	389
tC, single (s)	4.1				6.5	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.6	3.3
p0 queue free %	94				55	92
cM capacity (veh/h)	978				401	663

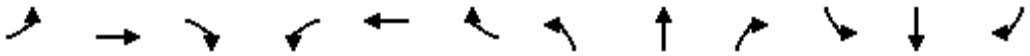
Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	195	611	232
Volume Left	63	0	179
Volume Right	0	442	53
cSH	978	1700	441
Volume to Capacity	0.06	0.36	0.53
Queue Length 95th (ft)	5	0	74
Control Delay (s)	3.3	0.0	21.8
Lane LOS	A		C
Approach Delay (s)	3.3	0.0	21.8
Approach LOS			C

Intersection Summary			
Average Delay	5.5		
Intersection Capacity Utilization	71.5%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	230	65	75	485	90	45
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	250	71	82	527	98	49
Pedestrians				2	1	
Lane Width (ft)				12.0	12.0	
Walking Speed (ft/s)				4.0	4.0	
Percent Blockage				0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			322		977	288
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			322		977	288
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			93		63	94
cM capacity (veh/h)			1243		262	754

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	321	609	147
Volume Left	0	82	98
Volume Right	71	0	49
cSH	1700	1243	335
Volume to Capacity	0.19	0.07	0.44
Queue Length 95th (ft)	0	5	54
Control Delay (s)	0.0	1.8	23.9
Lane LOS		A	C
Approach Delay (s)	0.0	1.8	23.9
Approach LOS			C

Intersection Summary			
Average Delay	4.2		
Intersection Capacity Utilization	68.5%	ICU Level of Service	C
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	35	255	10	95	530	60	10	30	65	20	20	25
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	37	268	11	100	558	63	11	32	68	21	21	26
Pedestrians					7			1			2	
Lane Width (ft)					12.0			12.0			12.0	
Walking Speed (ft/s)					4.0			4.0			4.0	
Percent Blockage					1			0			0	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)					1166							
pX, platoon unblocked	0.91						0.91	0.91		0.91	0.91	0.91
vC, conflicting volume	623			280			1175	1171	282	1230	1145	591
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	533			280			1141	1138	282	1202	1108	498
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	96			92			92	81	91	80	88	95
cM capacity (veh/h)	946			1282			127	163	757	104	169	522

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	316	721	111	68
Volume Left	37	100	11	21
Volume Right	11	63	68	26
cSH	946	1282	301	181
Volume to Capacity	0.04	0.08	0.37	0.38
Queue Length 95th (ft)	3	6	41	41
Control Delay (s)	1.4	2.0	23.7	36.5
Lane LOS	A	A	C	E
Approach Delay (s)	1.4	2.0	23.7	36.5
Approach LOS			C	E

Intersection Summary			
Average Delay	5.7		
Intersection Capacity Utilization	71.9%	ICU Level of Service	C
Analysis Period (min)	15		

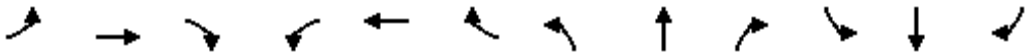
Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	115	40	325	25	75	30	385	520	15	25	455	115
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.0	4.0	3.5		4.0		3.5	4.0		3.5	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00		1.00		1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85		0.97		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00		0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1646	1750	1417		1680		1630	3187		1662	3260	1444
Flt Permitted	0.60	1.00	1.00		0.94		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1031	1750	1417		1599		1630	3187		1662	3260	1444
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	124	43	349	27	81	32	414	559	16	27	489	124
RTOR Reduction (vph)	0	0	81	0	11	0	0	1	0	0	0	86
Lane Group Flow (vph)	124	43	268	0	129	0	414	574	0	27	489	38
Heavy Vehicles (%)	1%	0%	5%	0%	0%	0%	2%	4%	0%	0%	2%	3%
Turn Type	custom		custom	Perm			Prot			Prot		Perm
Protected Phases					4		1	6		5	2	
Permitted Phases	8	8	1 8	4								2
Actuated Green, G (s)	14.6	14.6	45.5		14.6		26.9	48.0		2.6	23.7	23.7
Effective Green, g (s)	14.6	14.6	41.5		14.6		26.9	48.0		2.6	23.7	23.7
Actuated g/C Ratio	0.19	0.19	0.54		0.19		0.35	0.63		0.03	0.31	0.31
Clearance Time (s)	4.0	4.0			4.0		3.5	4.0		3.5	4.0	4.0
Vehicle Extension (s)	2.5	2.5			2.5		2.5	4.6		2.5	4.6	4.6
Lane Grp Cap (vph)	196	333	767		304		572	1994		56	1007	446
v/s Ratio Prot							c0.25	0.18		0.02	c0.15	
v/s Ratio Perm	c0.12	0.02	0.19		0.08							0.03
v/c Ratio	0.63	0.13	0.35		0.43		0.72	0.29		0.48	0.49	0.09
Uniform Delay, d1	28.6	25.8	10.0		27.4		21.7	6.5		36.4	21.5	18.8
Progression Factor	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	5.7	0.1	0.2		0.7		4.2	0.1		4.7	0.7	0.2
Delay (s)	34.3	25.9	10.2		28.1		25.9	6.7		41.1	22.2	19.0
Level of Service	C	C	B		C		C	A		D	C	B
Approach Delay (s)		17.3			28.1			14.7			22.4	
Approach LOS		B			C			B			C	

Intersection Summary			
HCM Average Control Delay	18.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	76.7	Sum of lost time (s)	11.5
Intersection Capacity Utilization	61.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	50	65	30	55	95	75	995	45	35	740	30
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			0.95			0.95	
Frpb, ped/bikes		0.99			0.99			1.00			1.00	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.95			0.93			0.99			0.99	
Flt Protected		0.99			0.99			1.00			1.00	
Satd. Flow (prot)		1614			1581			3203			3207	
Flt Permitted		0.70			0.89			0.82			0.86	
Satd. Flow (perm)		1152			1425			2625			2753	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	54	54	70	32	59	102	81	1070	48	38	796	32
RTOR Reduction (vph)	0	34	0	0	59	0	0	2	0	0	2	0
Lane Group Flow (vph)	0	144	0	0	134	0	0	1197	0	0	864	0
Confl. Peds. (#/hr)	7		9	9		7	3		7	7		3
Heavy Vehicles (%)	0%	0%	0%	4%	0%	0%	0%	3%	0%	0%	3%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		8			4			6			2	
Permitted Phases	8			4			6			2		
Actuated Green, G (s)		14.0			14.0			66.0			66.0	
Effective Green, g (s)		14.0			14.0			66.0			66.0	
Actuated g/C Ratio		0.16			0.16			0.75			0.75	
Clearance Time (s)		4.0			4.0			4.0			4.0	
Vehicle Extension (s)		2.5			2.5			6.1			6.1	
Lane Grp Cap (vph)		183			227			1969			2065	
v/s Ratio Prot												
v/s Ratio Perm		c0.13			0.09			c0.46			0.31	
v/c Ratio		0.79			0.59			0.61			0.42	
Uniform Delay, d1		35.6			34.3			5.1			4.0	
Progression Factor		1.00			1.00			1.24			1.00	
Incremental Delay, d2		19.2			3.4			1.0			0.6	
Delay (s)		54.8			37.8			7.3			4.6	
Level of Service		D			D			A			A	
Approach Delay (s)		54.8			37.8			7.3			4.6	
Approach LOS		D			D			A			A	

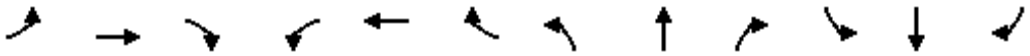
Intersection Summary			
HCM Average Control Delay	12.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	88.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	86.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	55	65	65	125	60	100	20	1210	95	40	825	30
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			0.95			0.95	
Frpb, ped/bikes		0.99			0.99			1.00			1.00	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.95			0.95			0.99			0.99	
Flt Protected		0.99			0.98			1.00			1.00	
Satd. Flow (prot)		1604			1607			3222			3179	
Flt Permitted		0.82			0.72			0.93			0.83	
Satd. Flow (perm)		1330			1175			3009			2653	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	57	67	67	129	62	103	21	1247	98	41	851	31
RTOR Reduction (vph)	0	25	0	0	24	0	0	5	0	0	2	0
Lane Group Flow (vph)	0	166	0	0	270	0	0	1361	0	0	921	0
Confl. Peds. (#/hr)	16		11	11		16	11		2	2		11
Confl. Bikes (#/hr)									2			
Heavy Vehicles (%)	4%	0%	0%	0%	0%	0%	0%	2%	0%	0%	4%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		8			4			6			2	
Permitted Phases	8			4			6			2		
Actuated Green, G (s)		22.9			22.9			57.1			57.1	
Effective Green, g (s)		22.9			22.9			57.1			57.1	
Actuated g/C Ratio		0.26			0.26			0.65			0.65	
Clearance Time (s)		4.0			4.0			4.0			4.0	
Vehicle Extension (s)		2.5			2.5			6.1			6.1	
Lane Grp Cap (vph)		346			306			1952			1721	
v/s Ratio Prot												
v/s Ratio Perm		0.12			c0.23			c0.45			0.35	
v/c Ratio		0.48			0.88			0.70			0.54	
Uniform Delay, d1		27.5			31.2			9.9			8.3	
Progression Factor		1.00			1.00			1.00			0.74	
Incremental Delay, d2		0.8			24.1			2.1			1.1	
Delay (s)		28.3			55.4			12.0			7.3	
Level of Service		C			E			B			A	
Approach Delay (s)		28.3			55.4			12.0			7.3	
Approach LOS		C			E			B			A	

Intersection Summary			
HCM Average Control Delay	16.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	88.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	92.8%	ICU Level of Service	F
Analysis Period (min)	15		

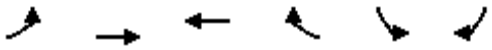
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	130	95	170	110	145	95	370	1155	20	105	795	140
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	5.0		4.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.90		1.00	0.94		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1662	1558		1598	1607		1662	3220		1662	3139	
Flt Permitted	0.35	1.00		0.30	1.00		0.25	1.00		0.10	1.00	
Satd. Flow (perm)	614	1558		505	1607		445	3220		182	3139	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	133	97	173	112	148	97	378	1179	20	107	811	143
RTOR Reduction (vph)	0	66	0	0	25	0	0	1	0	0	12	0
Lane Group Flow (vph)	133	204	0	112	220	0	378	1198	0	107	942	0
Confl. Peds. (#/hr)			1	1					1	1		
Confl. Bikes (#/hr)			1			3			1			
Heavy Vehicles (%)	0%	0%	1%	4%	1%	3%	0%	3%	0%	0%	4%	1%
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		8			4		1	6		5	2	
Permitted Phases	8			4			6			2		
Actuated Green, G (s)	22.2	22.2		22.2	22.2		64.5	63.5		46.8	46.8	
Effective Green, g (s)	22.2	22.2		22.2	22.2		64.5	63.5		46.8	46.8	
Actuated g/C Ratio	0.21	0.21		0.21	0.21		0.60	0.59		0.44	0.44	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	5.0		4.0	5.0	
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	6.1		2.0	6.1	
Lane Grp Cap (vph)	127	323		105	333		553	1911		194	1373	
v/s Ratio Prot		0.13			0.14		c0.16	0.37		0.04	c0.30	
v/s Ratio Perm	0.22			c0.22			0.25			0.20		
v/c Ratio	1.05	0.63		1.07	0.66		0.68	0.63		0.55	0.69	
Uniform Delay, d1	42.4	38.7		42.4	39.0		20.5	14.1		21.2	24.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	93.0	3.5		106.9	4.4		3.2	1.6		1.9	2.8	
Delay (s)	135.4	42.2		149.3	43.4		23.7	15.7		23.1	27.0	
Level of Service	F	D		F	D		C	B		C	C	
Approach Delay (s)		73.0			76.6			17.6			26.6	
Approach LOS		E			E			B			C	

Intersection Summary			
HCM Average Control Delay	33.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	107.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	88.8%	ICU Level of Service	E
Analysis Period (min)	15		

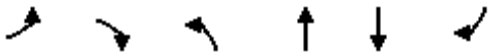
c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	25	180	165	30	35	20
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Hourly flow rate (vph)	31	225	206	38	44	25
Pedestrians					2	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					4.0	
Percent Blockage					0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	246				514	227
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	246				514	227
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				91	97
cM capacity (veh/h)	1318				510	816

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	256	244	69
Volume Left	31	0	44
Volume Right	0	38	25
cSH	1318	1700	591
Volume to Capacity	0.02	0.14	0.12
Queue Length 95th (ft)	2	0	10
Control Delay (s)	1.1	0.0	11.9
Lane LOS	A		B
Approach Delay (s)	1.1	0.0	11.9
Approach LOS			B

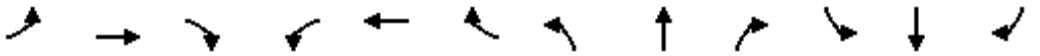
Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	36.8%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	10	10	80	1580	1055	40
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	11	11	85	1681	1122	43
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				TWLTL	TWLTL	
Median storage veh)				2	2	
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2154	582	1165			
vC1, stage 1 conf vol	1144					
vC2, stage 2 conf vol	1011					
vCu, unblocked vol	2154	582	1165			
tC, single (s)	7.1	6.9	4.1			
tC, 2 stage (s)	6.1					
tF (s)	3.7	3.3	2.2			
p0 queue free %	94	98	86			
cM capacity (veh/h)	165	461	607			

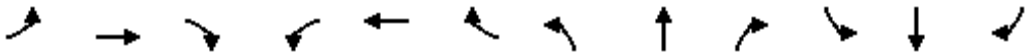
Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	21	85	840	840	748	417
Volume Left	11	85	0	0	0	0
Volume Right	11	0	0	0	0	43
cSH	243	607	1700	1700	1700	1700
Volume to Capacity	0.09	0.14	0.49	0.49	0.44	0.25
Queue Length 95th (ft)	7	12	0	0	0	0
Control Delay (s)	21.2	11.9	0.0	0.0	0.0	0.0
Lane LOS	C	B				
Approach Delay (s)	21.2	0.6			0.0	
Approach LOS	C					

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	57.4%	ICU Level of Service	B
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	85	20	125	15	85	240	150	1365	15	110	900	115
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)		5.0	5.0		5.0	5.0	5.0	6.0	6.0	5.0	6.0	6.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes		1.00	1.00		1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.96	1.00		0.99	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1534	1444		1680	1488	1599	3228	1457	1646	3197	1377
Flt Permitted		0.70	1.00		0.94	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1111	1444		1595	1488	1599	3228	1457	1646	3197	1377
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	91	22	134	16	91	258	161	1468	16	118	968	124
RTOR Reduction (vph)	0	0	114	0	0	220	0	0	2	0	0	20
Lane Group Flow (vph)	0	113	20	0	107	38	161	1468	14	118	968	104
Confl. Bikes (#/hr)									1			
Heavy Vehicles (%)	12%	0%	3%	0%	4%	0%	4%	3%	0%	1%	4%	8%
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		8			4		1	6		5	2	
Permitted Phases	8		8	4		4			6			2
Actuated Green, G (s)		13.6	13.6		13.6	13.6	13.7	50.1	50.1	11.5	47.9	47.9
Effective Green, g (s)		13.6	13.6		13.6	13.6	13.7	50.1	50.1	11.5	47.9	47.9
Actuated g/C Ratio		0.15	0.15		0.15	0.15	0.15	0.55	0.55	0.13	0.53	0.53
Clearance Time (s)		5.0	5.0		5.0	5.0	5.0	6.0	6.0	5.0	6.0	6.0
Vehicle Extension (s)		2.5	2.5		2.5	2.5	2.5	5.2	5.2	2.5	5.2	5.2
Lane Grp Cap (vph)		166	215		238	222	240	1773	800	208	1679	723
v/s Ratio Prot							c0.10	c0.45		0.07	0.30	
v/s Ratio Perm		c0.10	0.01		0.07	0.03			0.01			0.08
v/c Ratio		0.68	0.09		0.45	0.17	0.67	0.83	0.02	0.57	0.58	0.14
Uniform Delay, d1		36.7	33.5		35.4	33.9	36.6	17.0	9.4	37.5	14.7	11.1
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		10.0	0.1		1.0	0.3	6.5	3.8	0.0	2.9	0.8	0.2
Delay (s)		46.8	33.6		36.4	34.2	43.1	20.8	9.4	40.4	15.6	11.3
Level of Service		D	C		D	C	D	C	A	D	B	B
Approach Delay (s)		39.6			34.8			22.8			17.5	
Approach LOS		D			C			C			B	

Intersection Summary			
HCM Average Control Delay	23.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	91.2	Sum of lost time (s)	10.0
Intersection Capacity Utilization	76.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	5	20	70	5	190	10	1080	50	90	770	45
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)		4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor		1.00		1.00	1.00		1.00	0.95	1.00	1.00	0.95	
Frt		0.96		1.00	0.85		1.00	1.00	0.85	1.00	0.99	
Flt Protected		0.97		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1634		1662	1231		1662	3260	1261	1330	3207	
Flt Permitted		0.55		0.79	1.00		0.31	1.00	1.00	0.14	1.00	
Satd. Flow (perm)		922		1381	1231		549	3260	1261	194	3207	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	56	6	22	78	6	211	11	1200	56	100	856	50
RTOR Reduction (vph)	0	18	0	0	126	0	0	0	26	0	5	0
Lane Group Flow (vph)	0	66	0	78	91	0	11	1200	30	100	901	0
Heavy Vehicles (%)	0%	0%	0%	0%	0%	22%	0%	2%	18%	25%	3%	0%
Turn Type	Perm			Perm			pm+pt		Perm	pm+pt		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		9.9		9.9	9.9		31.6	31.0	31.0	39.6	35.0	
Effective Green, g (s)		9.9		9.9	9.9		31.6	31.0	31.0	39.6	35.0	
Actuated g/C Ratio		0.17		0.17	0.17		0.55	0.54	0.54	0.69	0.61	
Clearance Time (s)		4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)		3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		159		238	212		313	1758	680	224	1952	
v/s Ratio Prot					c0.07		0.00	c0.37		c0.04	0.28	
v/s Ratio Perm		0.07		0.06			0.02		0.02	0.27		
v/c Ratio		0.41		0.33	0.43		0.04	0.68	0.04	0.45	0.46	
Uniform Delay, d1		21.2		20.9	21.3		5.9	9.7	6.3	5.6	6.1	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		1.7		0.8	1.4		0.0	1.1	0.0	1.4	0.2	
Delay (s)		23.0		21.7	22.7		5.9	10.8	6.3	7.0	6.3	
Level of Service		C		C	C		A	B	A	A	A	
Approach Delay (s)		23.0			22.4			10.5			6.4	
Approach LOS		C			C			B			A	

Intersection Summary			
HCM Average Control Delay	10.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	57.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	68.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group